What is claimed is:

1. An apparatus, comprising:

a wave plate having oppositely positioned first and second faces forming a cavity;

a nematic liquid crystal material being disposed between said oppositely positioned cavity faces; and

a first plurality of electrodes located relative to at least said first face of said cavity,

wherein said first plurality of electrodes is configured to apply an electric field having a first component parallel to said first face, said first plurality of electrodes being able to rotate an orientation of said first electric field component and, hence, molecules of said liquid crystal material, by a plurality of angles.

2. The apparatus of claim 1, further comprising a first segment of an optical fiber being configured and positioned to transmit light to said wave plate through one of said faces and receive light from said wave plate from said one of said faces.

3. The apparatus of claim 2, wherein said first electrodes are configured and positioned on a front cross-sectional surface of said first optical fiber segment.

4. The apparatus of claim 1, further comprising,

a second plurality of electrodes located relative to said second face of said cavity,

wherein said second plurality of electrodes is configured to apply an electric field having a second component parallel to said second face, said second plurality of electrodes being able to rotate an orientation of said second electric field component and, hence, molecules of said liquid crystal material, by a plurality of angles.

5. The apparatus of claim 4, further comprising a first segment of an optical fiber being configured and positioned to transmit light to said wave plate through said first face and receive light from said wave plate from said first face and a second segment of an optical fiber being configured and positioned to transmit light to said wave plate through said second face and receive light from said wave plate from said second face.

6. The apparatus of claim 5, wherein said first electrodes are configured and positioned on a front cross-sectional surface of said first optical fiber segment and said second electrodes are configured and positioned on a front cross-sectional surface of said second optical fiber segment.

7. The apparatus of claim 1, further comprising a control system responsive to a state of polarization of light entering or leaving said wave plate to adjust said first electric field component such as to rotate a state of polarization of light to a target state.

8. The apparatus of claim 7, wherein said electric field is adjusted such as to cause said rotation of said molecules toward overshooting said target state.

9. The apparatus of claim 8, wherein said control system includes a generator of trigger pulses also applied to said first electrodes to increase said first electric field component such as to cause more rapid rotation of said molecules to said target direction.

10. The apparatus of claim 9, wherein said adjusted first electric field component is such as to cause the rotation of said state of polarization of said molecules by a prescribed rotation greater than said target state.

11. An apparatus, comprising:

first and second segments of an optical fiber;

at last one wave plate having oppositely positioned first and second faces forming a cavity, said first optical fiber segment having a front face adjacent to a central region of said first cavity face, and said second optical fiber segment having a front face adjacent to a central region of said second cavity face;

a nematic liquid crystal material being disposed between said oppositely positioned cavity faces; and

a first plurality of electrodes located relative to at least said first face of said cavity,

wherein said first plurality of electrodes is configured to apply an electric field parallel to said first face, said first plurality of electrodes being able to rotate an orientation of said electric field and, hence, molecules of said liquid crystal material, by a plurality of angles.

12. The apparatus of claim 11, further comprising:

a second plurality of electrodes located relative to said second face of said cavity,

wherein said second plurality of electrodes is configured to apply an electric field parallel to said second face, said second plurality of electrodes being able to rotate an orientation of said electric field and, hence, molecules of said liquid crystal material, by a plurality of angles.

13. The apparatus of claim 12 wherein said wave plate cavity has a first predetermined thickness to form a quarter wave plate and said wave plate cavity has a second predetermined thickness to form a half wave plate, a first quarter wave plate being connected in series by an optical fiber to said half wave plate, said half wave plate being connected in series by an optical fiber to a second quarter wave plate, an input optical fiber connected to an input of said first quarter wave plate, an output optical fiber being connected to an output of said second quarter wave plate, and an electric driver unit to control the orientation of the optical axis of each of said first quarter wave plate said half wave plate and said second quarter wave plate to yield at said output optical fiber a desired polarization rotation of the input optical signal supplied to said input optical fiber.

14. The apparatus of claim 12, wherein said first electrodes are configured and positioned on a front cross-sectional surface of said first optical fiber segment and said second electrodes are configured and positioned on a front cross-sectional surface of said second optical fiber segment.

15. The apparatus of claim 14, further including a polarizer disposed between said first electrodes and said front surface of said first optical fiber segment, wherein said apparatus is capable of measuring a state of polarization of light entering said wave plate.

16. The apparatus of claim 14, further comprising a control system responsive to a state of polarization of light entering or leaving said wave plate to adjust said first electric field component such as to rotate a state of polarization of light to a target state.

17. The apparatus of claim 16, wherein said first electrodes and said second electrodes are connected in a predetermined relationship with each other, and said first and second electric field components are adjusted such as to cause said rotation of said state of polarization of said molecules toward overshooting said target direction.

18. The apparatus of claim 17, wherein said control system includes a generator of trigger pulses also applied to said first and second electrodes to increase said electric field such as to cause more rapid rotation of said molecules to said target state, wherein said adjusted electric field is such as to cause the rotation of said state of polarization of said molecules by a prescribed rotation greater than said target state.

19. A method for use in an apparatus for controllably rotating a state of polarization including,

first and second segments of an optical fiber,

a wave plate having oppositely positioned first and second faces forming a cavity said first optical fiber segment having a front face adjacent to a central region of said first cavity face, and said second optical fiber segment having a front face adjacent to a central region of said second cavity face,

a nematic liquid crystal material being disposed between said oppositely positioned cavity faces, and

a first plurality of electrodes located relative to at least said first face of said cavity,

wherein said first plurality of electrodes is configured to apply an electric field having a first component parallel to said first face;

the method comprising:

generating an electric potential;

applying said electric potential to said first plurality of electrodes to generate an electric field parallel to said first face, said first plurality of electrodes being able to rotate an orientation of said electric field and, hence, molecules of said liquid crystal material, by a plurality of angles.

20. The method of claim 19, wherein said apparatus further includes,

a second plurality of electrodes located relative to said second face of said cavity,

wherein said second plurality of electrodes is configured to apply an electric field parallel to said second face, said second plurality of electrodes being able to rotate an orientation of said electric field and, hence, molecules of said liquid crystal material, by said plurality of angles,

said first electrodes are configured and positioned on a front cross-sectional surface of said first optical fiber segment and said second electrodes are configured and positioned on a front cross-sectional surface of said second optical fiber segment,

the method further comprising,

in response to a representation of a state of polarization of light entering or leaving said wave plate, adjusting an orientation of said molecules in a quarter wave plate forms by said cavity having a first predetermined thickness, in a half wave plate formed by said cavity having a second predetermined thickness and being in series with said first

quarter wave plate, in a second quarter wave plate being in series with said half wave plate, such as to rotate a state of polarization of light to said target state, and

generating trigger pulses also employed to adjust said electric field such as to more rapidly rotate said molecules toward overshooting said target state and, hence, the state of polarization of said light.